

Connecting Dots via Large Language Models

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Introduction

Our research aims to develop a methodology which helps understand the latent patterns in Knowledge Graphs.

(a) This study focuses on elaborating the seemingly black-box structure of an AI using Knowledge Graph reasoning.

(b) Given a link prediction task for KG completion, we try to understand the reasoning behind why the model chose the specific entity as the prediction.

(c) From the test results we observed that given a fact triple that exists in the KG, the model returns the event triples which are correlated to the given fact occurring in real-time.

Dataset

- Data from the ICEWS event dataset which is a collection of political and socio-economic events from around the world I used for the KG Reasoning task.
- It includes 20 CAMEO coded primary event categories which are further divided into more specific subcategories, resulting in more than 300 event types.
- Temporal and Textual meta-data associated with the facts was useful in in-context learning of the LLM

Language Models

For a given event quadruple in the form (source, relation, target, date), all the existing events from the dataset are extracted using Graph Traversal Techniques. These events are passed on to the Language Model along with the query quadruple to look for correlated events. Each extracted event quadruple has some text meta-data associated with it which helps the language model reason better about the correlation.

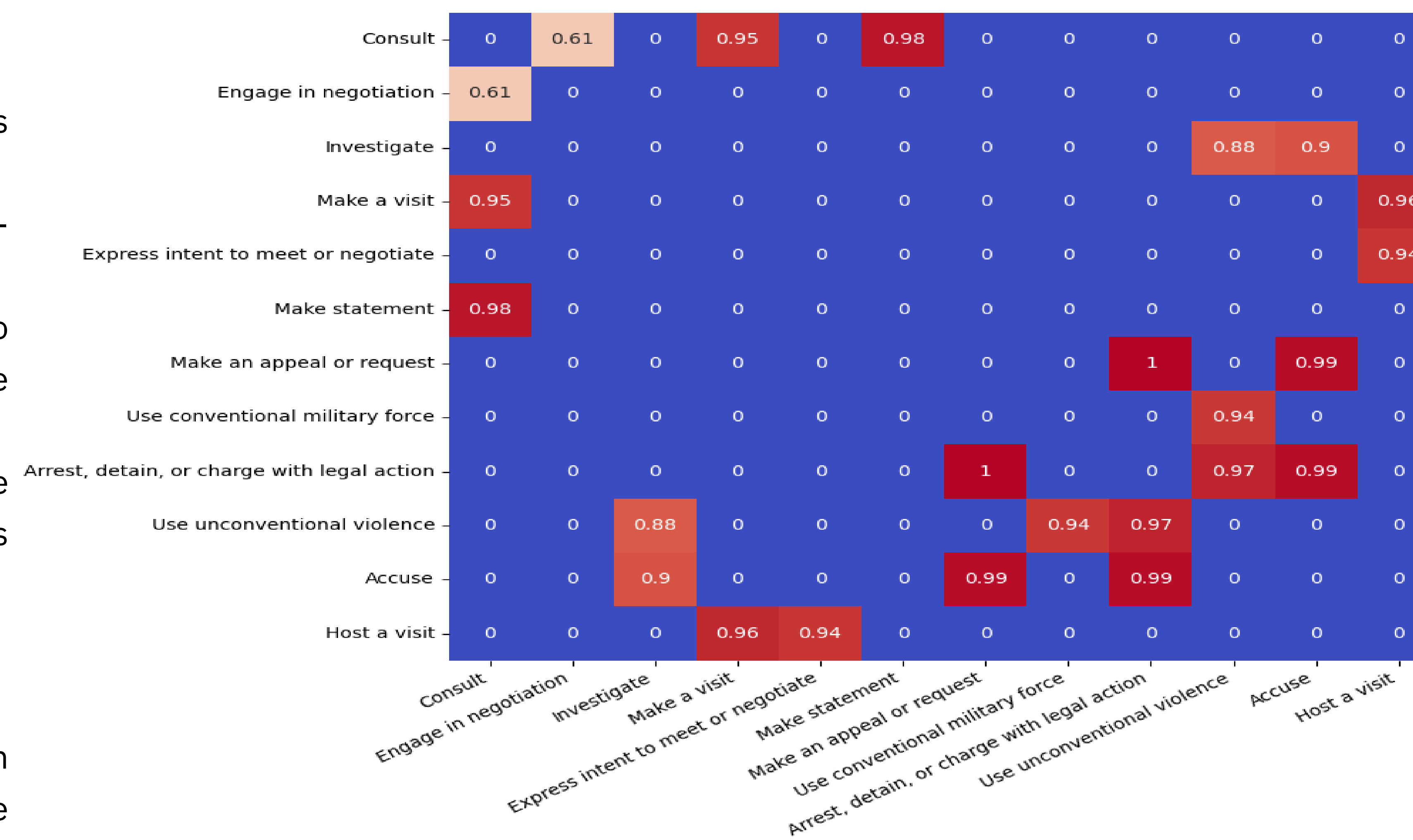


Fig 1: Events co-occurrence ratio

Co-occurring events

Some events occur more frequently than others and capturing those co-occurrences is crucial for extracting the correlational subgraphs.

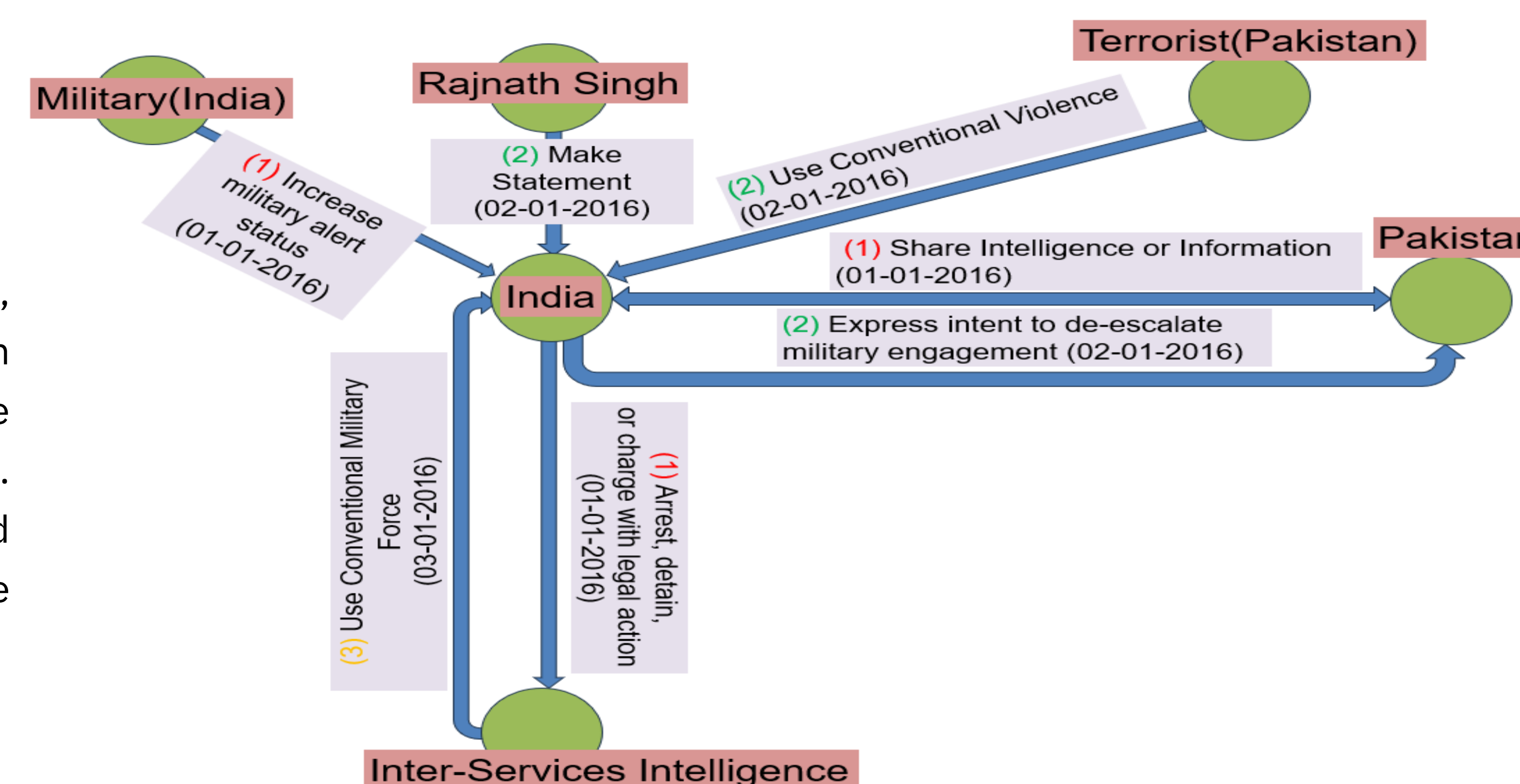


Fig 3: Extracted correlation Subgraph

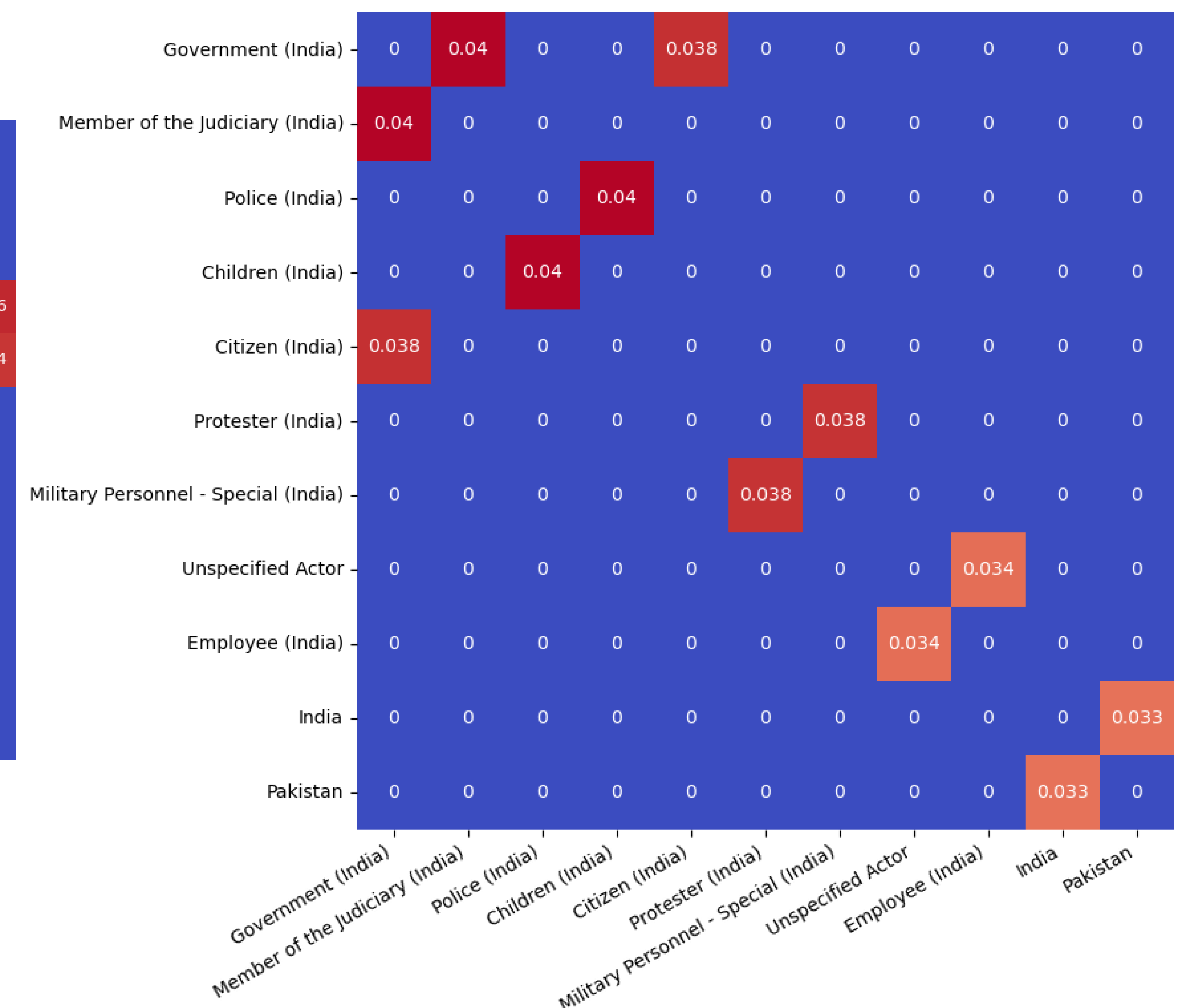


Fig 2: Entity co-occurrence ratio

Future Work

- The task of extracting subgraphs can be further improved by capturing the higher order relations within a graph using hypergraph.
- We can also try adding the temporal part to the embeddings for dynamic subgraph identification.

References

- Xiaoming Shi, et al. 2023 “Language Models Can Improve Event Prediction by Few-Shot Abductive Reasoning”.
- Armin Toroghi1, et al. 2024 “Right for Right Reasons: Large Language Models for Verifiable Commonsense Knowledge Graph Question Answering”